drawer and the disk will again be grasped by the picker and raised up above the drawer of the printer. The drawer is then closed. The disk is lowered by the picker to a cleaning area. The ionized brush moves across the lower surface of the disk to remove any dust or lint particles. The disk is then raised to a position above the recorder's drawer. The recorder's drawer is opened and the clean disk is placed into the drawer. The door is closed and data is recorded on the disk. Depending upon the type of recorder, the data recorded might also be verified at this stage. After the recording is complete, the recorder will open its drawer and the picker will grasp the disk and raise it up so the recorder's drawer can again close. If a separate verifier drive is to be used, the drawer of the verifier drive is opened and the picker places the disk into the open drawer. The verifier drive's drawer closes and the verifier drive checks the disk for recording accuracy. Once this step is complete, the drawer of the verifier drive opens, the picker grasps the disk and the disk is delivered either to the other removable holding bin on the sliding tray or to the reject tray depending upon the results of the verification step. This process can be repeated up to fifty times without reloading the input tray.

The operation of the device is under program control. This control program governs the operation of the sliding tray, the picker, the brush, and the drives. To provide this program control, the device will either have to include an internal controller or an interface allowing it to be coupled to an external controller such as a computer.

The design of the picker is also simple, inexpensive, lightweight, and relatively maintenance free. It includes a grasping mechanism for operating a set of picking fingers and an elevator for raising and lowering the grasping mechanism. The picking fingers of the grasping mechanism have a slight undercut which allows them to lift and hold a compact disk through its center hole when the fingers are expanded. The fingers are coupled to picking fingers to concentric slots in a circular disk. The disk is rotated in one direction by a solenoid and in the opposite direction by a spring. The disk is normally rotated by a spring to a position in which the fingers are held in the disk gripping, expanded position. The solenoid is capable of overcoming the force of the spring to rotate the disk in the opposite direction to compress the fingers and release the disk. The operation of the solenoid is governed by the controller.

The picker's elevator includes a pair of vertical guide shafts and a vertical helically threaded shaft all in parallel alignment. Rotation of the helically threaded shaft in one direction causes the grasping mechanism to rise. Rotation in the opposite direction causes the grasping mechanism to fall. Rotational movement of the helically threaded shaft is imparted by a pulley and belt arrangement which couples the helically threaded shaft to a slip clutch and stepper motor. Given this arrangement, the controller sends pulses to a stepper motor. This arrangement allows the movement of the elevator (and thus the height of the picker's fingers) to be precisely controlled. For added precision and to provide feedback to the controller, a rotary sensor is also provided to monitor movement of the elevator. This arrangement is an improvement over previous methods of moving the picking mechanism because it greatly simplified the design, reducing cost, weight and maintenance. Also, no other sensors are required to detect the presence of a disk, to prevent injury to the operator, or to prevent damage to the components of the device or the disks.

The cleaning brush is mounted to a retractable arm. The arm is extended and retracted by a motor to swipe across the bottom surface of the disk to remove any particles that could cause recording errors. The cleaning brush is ionized, specially coated and grounded. Again, this design is superior to previous methods. No manual intervention is required to clean the disks.

The sliding tray is designed so that two disk holders can be mounted on the tray, one in front of the other. Up to fifty disks are placed in a first holder and the second holder, is left empty. The disks are picked one at a time from the first holder, processed, and then placed in the second holder. When all fifty disks are produced, the second holder is removed, the first holder is repositioned to replace the second holder, and a new fifty-disk stack of disks in a third holder is placed in the original position of the first holder. This method is an improvement over previous methods since it offers a low cost method of transporting disks between workstations and eliminates the need to have the disks touched by human hands. The holders can also be used to transport a stack of disks to other stations or to insert the disks into standard beehive shipping containers.

These and other advantages and features of the present invention will become more clear by reading the following detailed description in view of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the transport, recording and verifying device of the present invention.

FIG. **2** is a front elevational view of the device shown in FIG. **1**.

FIG. **3** is a side view of the device shown in FIG. **1** with a portion cut away to expose interior features.

FIG. **4** is a side elevational view of the components of the elevator mechanism.

FIG. **5** is a front elevational view of the components of the elevator mechanism.

FIG. **6** is a bottom view showing the grasping mechanism of the picker.

FIG. **7** is a side view of the brush mechanism.

FIG. **8** is a top view of the brush mechanism.

FIG. **9** is a perspective view of the slidable disk tray.

FIG. **10** is a block diagram of the electronic interface used to control the components of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides an integrated system for publishing compact disks. Such disks, after processing by the system, include a label for identifying the disk and its contents. The disks will also have digital information recorded on them. Such digital information can have a variety of forms. It can be in the form of music to be played through an audio system equipped with a compact disk player. It can be in the form of movies or shows to be played through a television coupled to a DVD player. It can be in the form of computer programs, text files, graphics files or the like to be accessed using a personal computer. It can be in the form of games to be played on a special game player. Not only can the form of the information stored on the disk be varied, but the format used to store the information can also be varied to accommodate different types of reading or playing devices.

The system provided by the present invention is small, compact, inexpensive and ideally suited for short run compact disk production. The present invention will be described in the context of a system designed to automati-